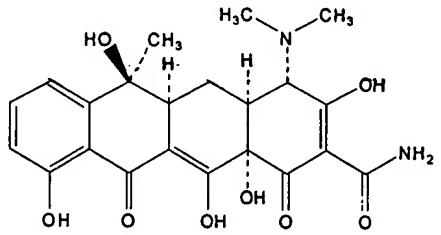
Monograph number: 09271
Title: Tetracycline
CAS Registry Number: 60-54-8
CAS Name: [4*S*-(4α,4aα,5aα,6β,12aα)]-4-(Dimethylamino)-1,4,4a,5,5a,6-11,12a-octahydro-3,6,10,12,12a-pentahydroxy-6-methyl-1,11-dioxo-2-naphthacenecarboxamide
Additional Names: deschlorobiomycin ; tsiklomitsin
Trademarks: Liquamycin (Pfizer)
Molecular Formula: $C_{22}H_{24}N_2O_8$
Molecular Weight: 444.43
Percent Composition: C 59.45%, H 5.44%, N 6.30%, O 28.80%
Literature References: Antibiotic substance produced by *Streptomyces spp.* Prepn: J. H. Boothe *et al., J. Am. Chem. Soc.* **75,** 4621 (1953); L. H. Conover *et al., ibid.* 4622; Conover, **US 2699054** (1955). Production by *Streptomyces viridifaciens:* Gourevitch, Lein, Heinemann *et al.,* **US 2712517**; **US 2886595** (1955, 1959 both to Bristol Labs.); by *S. aureofaciens:* Miller, Arishima, Sekizwa, **US 3005023**; **US 3019173** (1961, 1962 both to Am. Cyanamid). Purification: Kaplan, Granatek, **US 3301899** (1967 to Bristol-Myers). Total synthesis of tetracyclines: J. H. Boothe *et al., J. Am. Chem. Soc.* **81,** 1006 (1959); L. H. Conover *et al., ibid.* **84,** 3222 (1962). Graphic outline of Woodward synthesis: *Chem. Eng. News* **40,** 36 (Oct. 8, 1962). Abs config: V. N. Dobrynin *et al., Tetrahedron Lett.* **1962,** 901. Solubility studies: Weiss *et al., Antibiot. Chemother.* **7,** 374 (1957). Toxicity: E. I. Goldenthal, *Toxicol. Appl. Pharmacol.* **18,** 185 (1971). *Review:* "Tetracycline" in *The Technology of the Tetracyclines* **vol. I,** R. C. Evans, Ed. (Quadrangle Press, New York, 1968) pp 209-426. Mechanism of action: A. Kaji, M. Ryoji in *Antibiotics* **vol. 5** (pt. 1), F. E. Hahn, Ed. (Springer-Verlag, New York, 1979) pp 304-328. Review of biosynthesis: C. R. Hutchinson in *Antibiotics* **vol. 4,** J. W. Corcoran, Ed. (Springer-Verlag, New York, 1981) pp 1-12. Review of anticollagenase activity of tetracyclines: L. M. Golub *et al., Crit. Rev. Oral Biol. Med.* **2,** 297-322 (1991).



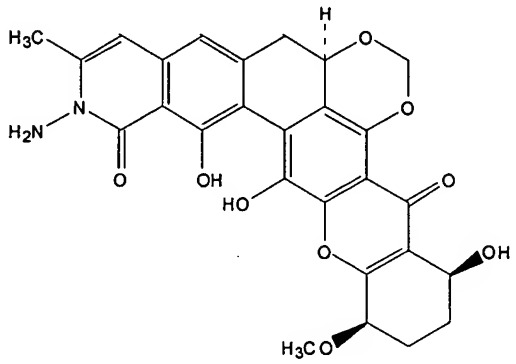
Properties: Trihydrate, crystals. Swells at 165°. Dec 170-175°. Becomes anhydr by drying *in vacuo* at 60° for 8 hrs. $[\alpha]_D^{25}$ -257.9° (0.1*N* HCl); $[\alpha]_D^{25}$ -239° (methanol). uv max (0.1*N* HCl): 220, 268, 355 nm (ε 13000, 18040, 13320). pKa (50% aq DMF): 8.3, 10.2. Stable in neutral and in alkaline soln. Soly at about 28°: 1.7 mg/ml water; >20 mg/ml methanol. LD_{50} in rats, mice (mg/kg): 807, 808 orally (Goldenthal).

Derivative Type: Hydrochloride
CAS Registry Number: 64-75-5
Trademarks: Achromycin (Wyeth) ; Ambramicina (Lepetit); Diocyclin (Cimex); Helvecyclin (Helvepharm); Hexacycline (Bristol-Myers Squibb); Hostacyclin (Hoechst); Imex (Merz); Panmycin (Pharmacia & Upjohn); Robitet (Wyeth); Steclin (Bristol-Myers Squibb); Sumycin (Bristol-Myers Squibb); Supramycin (Grünenthal); Sustamycin (Boehringer, Mann.); Tefilin (Hermal); Tetracyn (Pfizer); Tetralution (Merckle); Tetsol (Novartis); Topicycline (Roberts)
Molecular Formula: $C_{22}H_{24}N_2O_8.HCl$
Molecular Weight: 480.90

Percent Composition: C 54.95%, H 5.24%, N 5.83%, O 26.62%, Cl 7.37%
Properties: Crystals from butanol +HCl, dec 214°. $[\alpha]_D^{25}$ -257.9° (c = 0.5 in 0.1*N* HCl). Freely sol in water, sol in methanol, ethanol. Insol in ether, hydrocarbons. pH (2% aq soln): 2.1-2.3. LD_{50} orally in rats: 6443 mg/kg (Goldenthal).

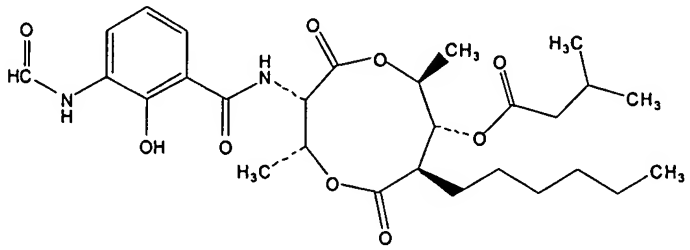
Derivative Type: Phosphate complex
CAS Registry Number: 1336-20-5
Trademarks: Tetrex (Bristol-Myers Squibb)
Literature References: Prepn: Seiger, Weidenheimer, **US 3053892** (1962 to Am. Cyanamid).
Properties: Yellow, odorless powder. Sparingly sol in water; slightly sol in ethanol.
Therapeutic Category: Antiamebic; antibacterial; antirickettsial.
Therapeutic Category (Vet.): Antibacterial.

Monograph number: 00211
Title: Albofungin
CAS Registry Number: 37895-35-5
CAS Name: [1*S*-(1α,4α,8aα)]-13-Amino-3,4,8a,13-tetrahydro-1,15,16-trihydroxy-4-methoxy-12-methyl-1*H*-xantheno[4',3',2':4,5][1,3]benzodioxino[7,6-*g*]isoquinoline-14,17(2*H*,9*H*)-dione
Molecular Formula: $C_{27}H_{24}N_2O_9$
Molecular Weight: 520.49
Percent Composition: C 62.30%, H 4.65%, N 5.38%, O 27.67%
Literature References: Antifungal antibiotic produced by *Streptomyces albus* var *fungistaticus (fungatus)* Solovyeva et Rudaya. Isoln procedure: Khokhlov, Liberman, *Proc. Symp. Antibiotics Prague* (May 1959) p 81. Structure: A. I. Gurevich *et al., Tetrahedron Lett.* **1972,** 1751. Stereochemistry: A. I. Gurevich *et al., ibid.* **1974,** 2801. Thought to be identical with ***Ba-180265*** described by Liu *et al.,* in *Antimicrob. Agents Chemother.* **1962,** 767. Chemical and biological properties: A.I. Gurevich *et al., Antibiotiki* **17,** 771 (1972).



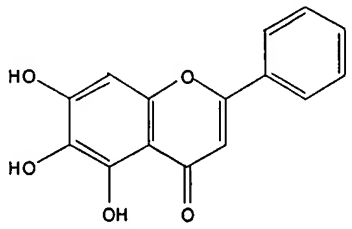
Properties: Crystals from nitromethane, mp 304-307°. Also reported as mp 190° (dec). $[\alpha]_D^{20}$ -670° (DMF). uv max (ethanol): 228, 254, 303, 376 nm (log ε 4.58, 4.58, 4.19, 4.42). Practically insol in water, petr ether. Sparingly sol in alcohol; quite sol in chloroform, dichloroethane, acetone, chlorobenzene, formamide, dimethylformamide, glacial acetic acid.

Monograph number: 00720
Title: Antimycin A_1
CAS Registry Number: 642-15-9
Additional Names: 3-Methylbutanoic acid 3-[[3-(formylamino)-2-hydroxybenzoyl]amino]-8-hexyl-2,6-dimethyl-4,9-dioxo-1,5-dioxonan-7-yl ester ; isovaleric acid 8-ester with 3-formamido-*N*-(7-hexyl-8-hydroxy-4,9-dimethyl-2,6-dioxo-1,5-dioxonan-3-yl)salicylamide
Molecular Formula: $C_{28}H_{40}N_2O_9$
Molecular Weight: 548.63
Percent Composition: C 61.30%, H 7.35%, N 5.11%, O 26.25%
Literature References: Antibiotic substance produced by *Streptomyces* spp. Isoln: Dunshee *et al., J. Am. Chem. Soc.* **71,** 2436 (1949); Lockwood *et al., Phytopathology* **44,** 438 (1954); **US 2657170** (1953 to Wisconsin Alumni Res. Found.). Structure: van Tamelen *et al., J. Am. Chem. Soc.* **83,** 1639 (1961); Birch *et al., J. Chem. Soc.* **1961,** 889. Absolute config.: Kinoshita *et al., J. Antibiot.* **25,** 373 (1972).



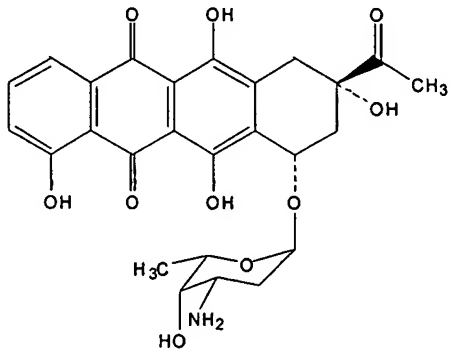
Properties: Crystals from ethyl acetate + Skellysolve B, mp 149-150°. $[\alpha]_D^{26}$ +76° (c = 1 in chloroform). uv max (alc): 226, 320 nm (log ε 4.54, 3.68). Freely sol in alc, ether, acetone, chloroform. Very slightly sol in petr ether, benzene, carbon tetrachloride. Practically insol in water and in 5% aq solns of hydrochloric acid, sodium carbonate and sodium bicarbonate. In aq sodium hydroxide a milky suspension is formed. This clears on warming, but all potency is lost.
Use: Experimentally as fungicide, insecticide, miticide.

Monograph number: 00944
Title: Baicalein
CAS Registry Number: 491-67-8
CAS Name: 5,6,7-Trihydroxy-2-phenyl-4*H*-1-benzopyran-4-one
Additional Names: 5,6,7-trihydroxyflavone ; noroxylin
Molecular Formula: $C_{15}H_{10}O_5$
Molecular Weight: 270.24
Percent Composition: C 66.67%, H 3.73%, O 29.60%
Literature References: From roots of *Scutellaria baicalensis.* Isoln and structure: Bargellini, *Gazz. Chim. Ital.* **49,** II, 47 (1919); Shibata *et al., Acta Phytochim.* **1,** 109 (1923). Synthesis: Sastri, Seshadri, *Proc. Indian Acad. Sci.* **23A,** 262 (1946), *C.A.* **41,** 449 (1947); Schönberg *et al., J. Am. Chem. Soc.* **77,** 5390 (1955); Jouanne, Mentzer, *Compt. Rend.* **254,** 727 (1962); Agasimundin, Siddappa, *J. Chem. Soc. Perkin Trans. 1* **1973,** 503. Pharmacology: Koda *et al., C.A.* **75,** 47200d (1971).



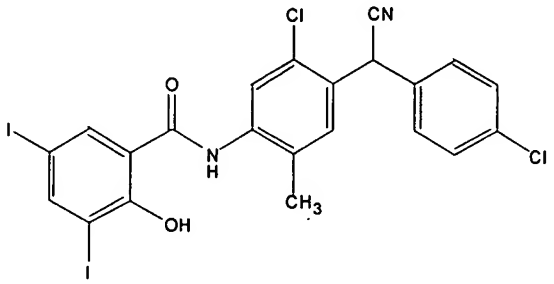
Properties: Yellow prisms from alc, dec 264-265°. uv max (ethanol): 324, 276 nm (log ε 4.18, 4.42). Sol in alcohol, methanol, ether, acetone, ethyl acetate, hot glacial acetic acid. Sparingly sol in chloroform, nitrobenzene. Practically insol in water. Sol in dil NaOH with greenish-brown color. Concd H_2SO_4 gives yellow color, green fluorescence.
Therapeutic Category: Astringent.

Monograph number: 01885
Title: Carubicin
CAS Registry Number: 50935-04-1
CAS Name: (8*S-cis*)-Acetyl-10-[(3-amino-2,3,6-trideoxy-α-L-*lyxo*-hexopyranosyl)oxy]-7,8,9,10-tetrahydro-1,6,8,11-tetrahydroxy-5,12-naphthacenedione
Additional Names: (1*S*,3*S*)-3-acetyl-1,2,3,4,6,11-hexahydro-3,5,10,12-tetrahydroxy-6,11-dioxo-1-naphthacenyl 3-amino-2,3,6-trideoxy-α-L-*lyxo*-hexopyranoside ; 4-*O*-demethyldaunorubicin; carminomycin; carminomycin I; karminomycin
Molecular Formula: $C_{26}H_{27}NO_{10}$
Molecular Weight: 513.49
Percent Composition: C 60.81%, H 5.30%, N 2.73%, O 31.16%
Literature References: Anthracycline antitumor antibiotic, related to daunorubicin and doxorubicin, *q.q.v.* Isoln from *Actinomadura carminata:* G. F. Gauze *et al., Antibiotiki* **18,** 675 (1973); M. G. Brazhnikova *et al., ibid.* 678. Antitumor activity: V. A. Shorin *et al., ibid.* 681. Physico-chemical characteristics, structure: M. G. Brazhnikova *et al., J. Antibiot.* **27,** 254 (1974). Pharmacokinetics, pharmacodynamics, toxicity study: L. E. Goldberg *et al., Antibiotiki* **19,** 57 (1974). Production: M. G. Brazhnikova *et al.,* **SU 508076** (1976 to Inst. Antibiot. Res., USSR), *C.A.* **86,** 15215 (1977). Stereochemistry: *eidem, J. Antibiot.* **29,** 469 (1976). Synthesis from daunomycinone: G. Cassinelli *et al., ibid.* **31,** 178 (1978). Molecular pharmacology: V. H. DuVernay *et al., Cancer Res.* **40,** 387 (1980). Analysis in human serum: S. E. Fandrich, K. A. Pittman, *J. Chromatogr.* **223,** 155 (1981). Early clinical studies: L.H. Baker *et al., Cancer Treat. Rep.* **63,** 899 (1979). Embryotoxicity and teratogenicity study: I. Damjanov, A. Celluzzi, *Res. Commun. Chem. Pathol. Pharmacol.* **28,** 497 (1980).



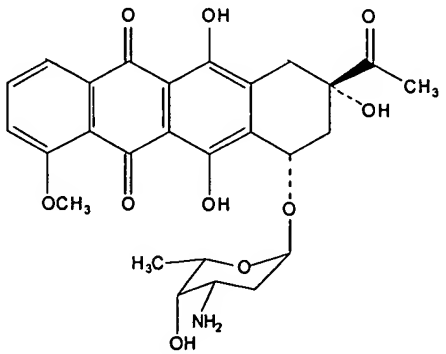
Derivative Type: Hydrochloride
CAS Registry Number: 52794-97-5
Manufacturers' Codes: NSC-180024
Molecular Formula: $C_{26}H_{27}NO_{10}.HCl$
Molecular Weight: 549.95
Percent Composition: C 56.78%, H 5.13%, N 2.55%, O 29.09%, Cl 6.45%
Properties: Crystals from ethanol/benzene. $[\alpha]_D^{20}$ +289°. uv max (ethanol): 236, 255, 462, 478, 492 ($E^{1\%}_{m}$ 300), 510, 525 nm. pKa_1 8.00; pKa_2 10.16. Sol in water, methanol. Practically insol in other organic solvents. LD_{50} in mice (mg/kg): 7.3 orally; 1.3 i.v.; 3.7 s.c. (Goldberg).
Therapeutic Category: Antineoplastic.

Monograph number: 02437
Title: Closantel
CAS Registry Number: 57808-65-8
CAS Name: *N*-[5-Chloro-4-[(4-chlorophenyl)cyanomethyl]-2-methylphenyl]-2-hydroxy-3,5-diiodobenzamide
Manufacturers' Codes: R-31520
Trademarks: Flukiver (Janssen) ; Seponver (Ethnor)
Molecular Formula: $C_{22}H_{14}Cl_2I_2N_2O_2$
Molecular Weight: 663.07
Percent Composition: C 39.85%, H 2.13%, Cl 10.69%, I 38.28%, N 4.22%, O 4.83%
Literature References: Salicylanilide derivative. Prepn: M. A. C. Janssen, V. K. Sipido, **BE 839481**; *eidem,* **US 4005218** (1976, 1977 both to Janssen). Effectiveness against *Taenia pisiformis* in rabbits: R. A. F. Chevis *et al., Vet. Parasitol.* **7,** 333 (1980); against *Ancylostoma caninum:* J. Guerrero *et al., J. Parasitol.* **68,** 616 (1983); against *Fasciola hepatica* in sheep: B. E. Stromberg *et al., ibid.* **70,** 446 (1984). Prolonged effect on *Haemonchus contortus* in sheep: C. A. Hall *et al., Res. Vet. Sci.* **31,** 104 (1981). Acts by uncoupling oxidative phosphorylation: H. Van den Bossche *et al., Arch. Int. Physiol. Biochim.* **87,** 851 (1979); H. J. Kane *et al., Mol. Biochem. Parasitol.* **1,** 347 (1980).



Properties: Crystals from methanol, mp 217.8°.
Therapeutic Category (Vet.): Anthelmintic.

Monograph number: 02852
Title: Daunorubicin
CAS Registry Number: 20830-81-3
CAS Name: (8*S-cis*)-8-Acetyl-10-[(3-amino-2,3,6-trideoxy-α-L-*lyxo*-hexopyranosyl)oxy]-7,8,9,10-tetrahydro-6,8,11-trihydroxy-1-methoxy-5,12-naphthacenedione
Additional Names: daunomycin ; leukaemomycin C; rubidomycin
Manufacturers' Codes: RP-13057
Trademarks: Cerubidin (M & B)
Molecular Formula: $C_{27}H_{29}NO_{10}$
Molecular Weight: 527.52
Percent Composition: C 61.47%, H 5.54%, N 2.66%, O 30.33%
Literature References: Anthracycline antibiotic related to the rhodomycins, *q.v.* Isolated from fermentation broths of *Streptomyces peucetius:* G. Cassinelli, P. Orezzi, *G. Microbiol.* **11,** 167 (1963), *C.A.* **62,** 9482b (1965); A. Di Marco *et al., Nature* **201,** 706 (1964); *eidem,* **BE 639897**; *eidem,* **US 4012284** (1964, 1977 both to Soc. Farmaceut. Italia); S. Pinnert *et al.,* **US 3997662** (1976 to Rhone-Poulenc). Daunorubicin is a glycoside formed by a tetracyclic aglycone, ***daunomycinone***, ($C_{21}H_{18}O_8$) and an amino sugar, ***daunosamine***, ($C_6H_{13}NO_3$), 3-amino-2,3,6-trideoxy-L-*lyxo*-hexose: F. Arcamone *et al., J. Am. Chem. Soc.* **86,** 5334, 5335 (1964); R. H. Iwamoto *et al., Tetrahedron Lett.* **1968,** 3891. Absolute stereochemistry: F. Arcamone *et al., Gazz. Chim. Ital.* **100,** 949-989 (1970). Identity with rubidomycin: G. L. Tong *et al., J. Pharm. Sci.* **56,** 1691 (1967). Synthesis of daunosamine: J. P. Marsh *et al., Chem. Commun.* **1967,** 973; T. Yamaguchi, M. Kojimo, *Carbohydr. Res.* **59,** 343 (1977); P. M. Wovkulich, M. R. Uskokovic, *J. Am. Chem. Soc.* **103,** 3956 (1981); of daunomycinone: C. M. Wong *et al., Can. J. Chem.* **51,** 466 (1973); J. S. Swenton, P. W. Reynolds, *J. Am. Chem. Soc.* **100,** 6188 (1978); K. Krohn, K. Tolkiehn, *Ber.* **112,** 3453 (1979); F. M. Hauser, S. Prasanna, *J. Am. Chem. Soc.* **103,** 6378 (1981). Total synthesis of daunorubicin: E. M. Acton *et al., J. Med. Chem.* **17,** 659 (1974). Purification: E. Oppici *et al.,* **BE 898506**; *eidem,* **GB 2133005** (both 1984 to Farmitalia). Toxicity data: A. Di Marco *et al., Cancer Chemother. Rep. Part 1* **53,** 33 (1969). Review of properties, biosynthesis, fermentation: R. J. White, R. M. Stroshane, *Drugs Pharm. Sci.* **22,** 569-594 (1984); of carcinogenic action in laboratory animals: *IARC Monographs* **10,** 145-152 (1976); of toxicology: R. J. Maral *et al., Cancer Treat. Rep.* **65,** Suppl. 4, 9-18 (1981); of use in treatment of solid tumors: R. B. Weiss *et al., ibid.* 25-28; of interactions with nucleic acids: S. Neidle, M. R. Sanderson, in *Molecular Aspects of Anti-cancer Drug Action,* S. Neidle, M. J. Waring, Eds. (Verlag-Chemie, Florida, 1983) pp 35-55; of mechanism of cytotoxicity: H. S. Schwartz, *ibid.* pp 93-125; of metabolism and clinical pharmacokinetics: C. E. Riggs, Jr., *Semin. Oncol.* **11,** Suppl. 3, 2-11 (1984). *Review:* A. DiMarco *et al., Antibiotics* **vol. 3,** J. W. Corcoran, F. E. Hahn, Eds. (Springer Verlag, New York, 1975) pp 101-128.



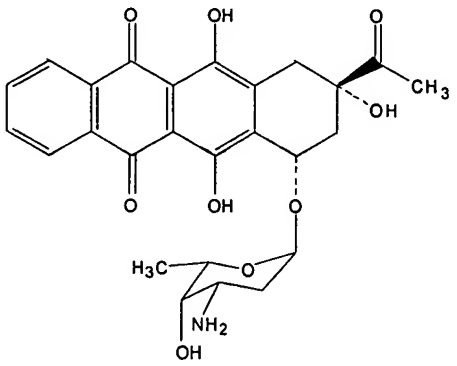
Daunomycinone

Daunosamine

Properties: mp 208-209°. LD_{50} in mice, rats (mg/kg): 20, 13 i.v.; 5, 8 i.p. (DiMarco, 1977).

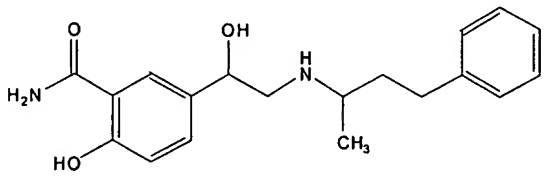
Derivative Type: Hydrochloride
CAS Registry Number: 23541-50-6
Trademarks: Cérubidine (Rhône-Poulenc) ; Daunoblastina (Farmitalia); Ondena (Bayer)
Molecular Formula: $C_{27}H_{29}NO_{10}.HCl$
Molecular Weight: 563.98
Percent Composition: C 57.50%, H 5.36%, N 2.48%, O 28.37%, Cl 6.29%
Properties: Thin red needles, dec 188-190°. $[\alpha]_D^{20}$ +248 ±5° (c = 0.05-0.1 in methanol). Sol in water, methanol, aq alcohols. Practically insol in chloroform, ether, benzene. Color of aq soln changes from pink at acid pH to blue at alkaline pH. Absorption max (methanol): 234, 252, 290, 480, 495, and 532 nm ($E_{1cm}^{1\%}$ 665, 462, 153, 214, 218, and 112). LD_{50} in mice (mg/kg): 26 i.v. (DiMarco, 1969).
Therapeutic Category: Antineoplastic.

Monograph number: 04911
Title: Idarubicin
CAS Registry Number: 58957-92-9
CAS Name: (7*S*,9*S*)-9-Acetyl-7-[(3-amino-2,3,6-trideoxy-α-L-*lyxo*-hexopyranosyl)oxy]-7,8,9,10-tetrahydro-6,9,11-trihydroxy-5,12-naphthacenedione
Additional Names: (1*S*,3*S*)-3-acetyl-1,2,3,4,6,11-hexahydro-3,5,12-trihydroxy-6,11-dioxo-1-naphthacenyl-3-amino-2,3,6-trideoxy-α-L-*lyxo*-hexopyranoside ; 4-demethoxydaunomycin; 4-demethoxydaunorubicin; DMDR
Manufacturers' Codes: IMI-30 ; NSC-256439
Molecular Formula: $C_{26}H_{27}NO_9$
Molecular Weight: 497.49
Percent Composition: C 62.77%, H 5.47%, N 2.82%, O 28.94%
Literature References: Orally active anthracycline; analog of daunorubicin, *q.v.* Prepn: B. Patelli *et al.* **DE 2525633**; *eidem,* **US 4046878** (1976, 1977 both to Soc. Farmac. Ital.); and antitumor activity: F. Arcamone *et al., Cancer Treat. Rep.* **60,** 829 (1976). Total synthesis for larger scale preparation: M. J. Broadhurst *et al., Chem. Commun.* **1982,** 158. Synthesis of optically pure isomers: Y. Kimura *et al., Bull. Chem. Soc. Jpn.* **59,** 423 (1986). Metabolism and biodistribution in rats: G. Zini *et al., Cancer Chemother. Pharmacol.* **16,** 107 (1986). HPLC determn in plasma: S. S. N. De Graaf *et al., J. Chromatogr.* **491,** 501 (1989). Clinical pharmacokinetics: H. C. Gillies *et al., Br. J. Clin. Pharmacol.* **23,** 303 (1987). Clinical evaluation of cardiac toxicity: F. Villani *et al., Eur. J. Cancer Clin. Oncol.* **25,** 13 (1989). Reviews of pharmacology and antitumor efficacy: A. M. Casazza, *Cancer Treat. Rep.* **63,** 835-844 (1979); F. Ganzina *et al., Invest. New Drugs* **4,** 85-105 (1986). Symposium on clinical experience in acute leukemias: *Semin. Oncol.* **17,** Suppl. 2, 1-36 (1989).



Derivative Type: Hydrochloride
CAS Registry Number: 57852-57-0
Trademarks: Idamycin (Pharmacia & Upjohn) ; Zavedos (Pharmacia & Upjohn)
Molecular Formula: $C_{26}H_{27}NO_9.HCl$
Molecular Weight: 533.95
Percent Composition: C 58.48%, H 5.29%, N 2.62%, O 26.97%, Cl 6.64%
Properties: Orange crystalline powder, mp 183-185° (Arcamone); also reported as mp 172-174° (Broadhurst). $[\alpha]_D^{20}$ +205° (c = 0.1 in methanol) (Arcamone); also reported as $[\alpha]_D^{20}$ +188° (c = 0.10 in methanol) (Kimura).
Therapeutic Category: Antineoplastic.

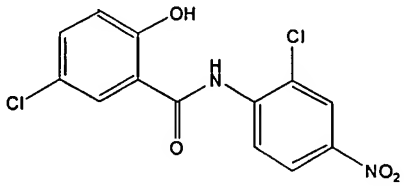
Monograph number: 05344
Title: Labetalol
CAS Registry Number: 36894-69-6
CAS Name: 2-Hydroxy-5-[1-hydroxy-2-[(1-methyl-3-phenylpropyl)amino]ethyl]benzamide
Additional Names: 5-[1-hydroxy-2-[(1-methyl-3-phenylpropyl)amino]ethyl]salicylamide ; ibidomide
Molecular Formula: $C_{19}H_{24}N_2O_3$
Molecular Weight: 328.41
Percent Composition: C 69.49%, H 7.37%, N 8.53%, O 14.62%
Literature References: A specific competitive antagonist at both α- and β-adrenergic receptor sites. Prepn: L. H. Lunts, D. T. Collin, **DE 2032642**; *eidem,* **US 4012444** (1971, 1977 both to Allen & Hanburys); J. E. Clifton *et al., J. Med. Chem.* **25,** 670 (1982). Pharmacology: J. B. Farmer *et al., Br. J. Pharmacol.* **45,** 660 (1972). Clinical studies: J. G. Collier *et al., ibid.* **44,** 286 (1972); D. A. Richards *et al., Br. J. Clin. Pharmacol.* **1,** 505 (1974). Metabolism in animals and man: R. Hopkins *et al., Biochem. Soc. Trans.* **4,** 726 (1976). HPLC determn in serum: T. F. Woodman, B. Johnson, *Ther. Drug Monit.* **3,** 371 (1981). Synthesis of stereoisomers and comparison of cardiovascular properties: *J. Med. Chem.* **25,** 1363 (1982). Series of articles on pharmacology, metabolism and clinical studies: *Br. J. Clin. Pharmacol.* **3,** Suppl. 3, 681S-824S (1976); *ibid.* **8,** Suppl. 2, 85S-244S (1979); *ibid.* **13,** Suppl. 1, 1S-141S (1982). Toxicity: K. Shimpo *et al., Hokkaido Igaku Zasshi* **53,** 15 (1978), *C.A.* **90,** 66465v (1974). *Review:* R. T. Brittain *et al.* in *Pharmacological and Biochemical Properties of Drug Substances* **vol. 2,** M. E. Goldberg, Ed. (Am. Pharm. Assoc., Washington, DC, 1979) pp 229-254.



Derivative Type: Hydrochloride
CAS Registry Number: 32780-64-6
Manufacturers' Codes: AH-5158A ; Sch-15719W
Trademarks: Amipress (Dox-Al) ; Ipolab (Finmedical); Labelol (Elea); Labrocol (Lagap); Normodyne (Schering); Presdate (Alfa); Pressalolo (Locatelli); Trandate (Allen & Hanburys)
Molecular Formula: $C_{19}H_{24}N_2O_3.HCl$
Molecular Weight: 364.87
Percent Composition: C 62.54%, H 6.91%, N 7.68%, O 13.15%, Cl 9.72%
Properties: White crystalline solid from ethanol-ethyl acetate, mp 187-189°. Sol in water, ethanol. Insol in ether, chloroform. LD_{50} in male, female mice, male, female rats (mg/kg): 114, 120, 113, 107 i.p.; 47, 54, 60, 53 i.v.; 1450, 1800, 4550, 4000 orally (Shimpo).

Derivative Type: *(R,R)*-Isomer
see Dilevalol
Therapeutic Category: Antihypertensive.

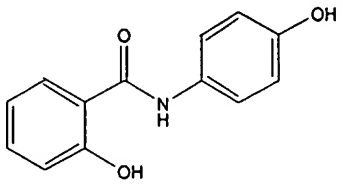
Monograph number: 06543
Title: Niclosamide
CAS Registry Number: 50-65-7
CAS Name: 5-Chloro-*N*-(2-chloro-4-nitrophenyl)-2-hydroxybenzamide
Additional Names: 2',5-dichloro-4'-nitrosalicylanilide ; 5-chloro-*N*-(2'-chloro-4'-nitrophenyl) salicylamide; 5-chlorosalicyloyl-(*o*-chloro-*p*-nitranilide); *N*-(2'-chloro-4'-nitrophenyl)-5-chlorosalicylamide
Manufacturers' Codes: Bayer 2353
Trademarks: Cestocide (Bayer) ; Niclocide (Miles); Ruby (Spencer); Trédémine (RPR); Yomesan (Bayer)
Molecular Formula: $C_{13}H_8Cl_2N_2O_4$
Molecular Weight: 327.12
Percent Composition: C 47.73%, H 2.47%, Cl 21.68%, N 8.56%, O 19.56%
Literature References: Prepn: **GB 824345** (1959 to Bayer), *C.A.* **54,** 15822b (1960). *See also:* E. Schraufstätter, R. Gönnert, **US 3079297**; R. Strufe *et al.,* **US 3113067** (both 1963 to Bayer); Bekhli *et al., Med. Prom. SSSR* **1965,** 25.



Properties: Pale yellow crystals, mp 225-230°. Practically insol in water. Sparingly sol in ethanol, chloroform, ether.

Derivative Type: Ethanolamine salt
CAS Registry Number: 1420-04-8
Additional Names: Clonitrilide
Trademarks: Bayluscid (Bayer)
Molecular Formula: $C_{13}H_8Cl_2N_2O_4.C_2H_7NO$
Molecular Weight: 388.20
Percent Composition: C 46.41%, H 3.89%, Cl 18.27%, N 10.82%, O 20.61%
Properties: Yellow-brown solid, mp 204°.
Use: The ethanolamine salt as a molluscicide.
Therapeutic Category: Anthelmintic (Cestodes).
Therapeutic Category (Vet.): Anthelmintic (Cestodes).

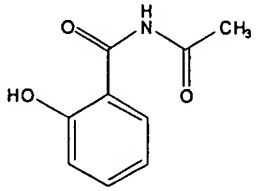
Monograph number: 06956
Title: Osalmid
CAS Registry Number: 526-18-1
CAS Name: 2-Hydroxy-*N*-(4-hydroxyphenyl)benzamide
Additional Names: 4'-hydroxysalicylanilide ; *N*-(*p*-hydroxyphenyl)salicylamide; *N*-salicoylaminophenol; oksafenamide; oxaphenamide
Trademarks: Driol (Sanofi) ; Jestmin (Kyowa); Kanochol (Taiyo); Saryuurin (Nippon Shoji); Yoshicol (Yoshitomi)
Molecular Formula: $C_{13}H_{11}NO_3$
Molecular Weight: 229.23
Percent Composition: C 68.11%, H 4.84%, N 6.11%, O 20.94%
Literature References: Prepn: Weizmann *et al., J. Org. Chem.* **13,** 796 (1948). Description: *Subsidia Med.* **8,** 103 (1956). HPLC determn in plasma: T. Sadanaga *et al., J. Chromatogr.* **223,** 243 (1981).



Properties: Crystals, mp 179°. Practically insol in cold water, acetic acid. Slightly sol in warm water, benzene, toluene. Freely sol in methanol, ethanol, ether, acetone.

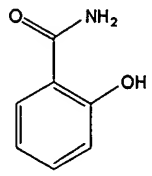
Derivative Type: Diacetate
Molecular Formula: $C_{17}H_{15}NO_5$
Molecular Weight: 313.30
Percent Composition: C 65.17%, H 4.83%, N 4.47%, O 25.53%
Properties: Needles from alcohol, mp 151°.
Therapeutic Category: Choleretic.

Monograph number: 08398
Title: Salacetamide
CAS Registry Number: 487-48-9
CAS Name: *N*-Acetyl-2-hydroxybenzamide
Additional Names: *N*-acetylsalicylamide ; acetsalicylamide
Trademarks: Actylamide (Rougier)
Molecular Formula: $C_9H_9NO_3$
Molecular Weight: 179.17
Percent Composition: C 60.33%, H 5.06%, N 7.82%, O 26.79%
Literature References: Prepn: Hicks, *J. Chem. Soc.* **97,** 1033 (1910); Anshutz, Mitarbeiter, *Ann.* **442,** 25 (1925); **BE 496438** (1950 to Soc. Belge de l'Azote Prod. Chim. Marly); Prost, Charlier, *Experientia* **18,** 319 (1962). Metabolism: Rayet *et al., Arch. Int. Pharmacodyn. Ther.* **88,** 159 (1951).



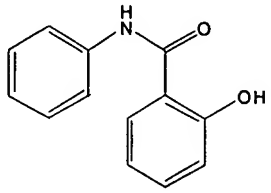
Properties: mp 148°.
Therapeutic Category: Analgesic, antipyretic, anti-inflammatory.

Monograph number: 08407
Title: Salicylamide
CAS Registry Number: 65-45-2
CAS Name: 2-Hydroxybenzamide
Trademarks: Salamid (Hamilton) ; Samid (Knoll); Cidal (CID); Salizell (Byk-Gulden); Salymid (Biochemie); Urtosal (Lifepharma)
Molecular Formula: $C_7H_7NO_2$
Molecular Weight: 137.14
Percent Composition: C 61.31%, H 5.14%, N 10.21%, O 23.33%
Literature References: Prepn: A. Cahours, *Ann.* **48,** 60 (1843); D. S. Hoffenberg, C. R. Hauser, *J. Org. Chem.* **20,** 1496 (1955); J. B. Chattopadhyaya, A. V. Rama Rao, *Tetrahedron* **30,** 2899 (1974). Toxicity data: Hart, *J. Pharmacol. Exp. Ther.* **89,** 205 (1947). Clinical efficacy in headache: W. J. Murray, *J. Clin. Pharmacol. J. New Drugs* **7,** 150 (1967). Pharmacokinetics: A. G. de Boer *et al., Biopharm. Drug Dispos.* **4,** 321 (1983).



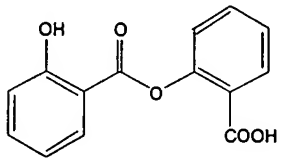
Properties: White or slightly pink, crystalline powder, somewhat bitter taste. Sensation of warmth on tongue. mp 140°. Soly in water at 30° = 0.2%, at 47° = 0.8%; in glycerol at 5° = 2.0%, at 39° = 5.0%, at 60° = 10.0%; in propylene glycol at 5° = 10.0%. Sol in hot water, alcohol, chloroform, ether. pH of satd aq soln at 28° about 5. Forms a water-soluble sodium salt at pH 9. LD_{50} orally in mice: 1.4 g/kg (Hart).
Therapeutic Category: Analgesic.

Monograph number: 08409
Title: Salicylanilide
CAS Registry Number: 87-17-2
CAS Name: 2-Hydroxy-*N*-phenylbenzamide
Additional Names: *N*-phenylsalicylamide
Trademarks: Salinidol (Doak)
Molecular Formula: $C_{13}H_{11}NO_2$
Molecular Weight: 213.23
Percent Composition: C 73.23%, H 5.20%, N 6.57%, O 15.01%
Literature References: Usually made by the reaction of salicylic acid with aniline in the presence of PCl_3 at an elevated temp. Better yields are obtained by using an inert organic solvent such as toluene or carbon tetrachloride as a reaction diluent. Novel process using ion-exchange resins: Majewski, Skelly, **US 3221051** (1965). Alternate process: Majewski *et al.*, **US 3231611** (1966 to Dow).



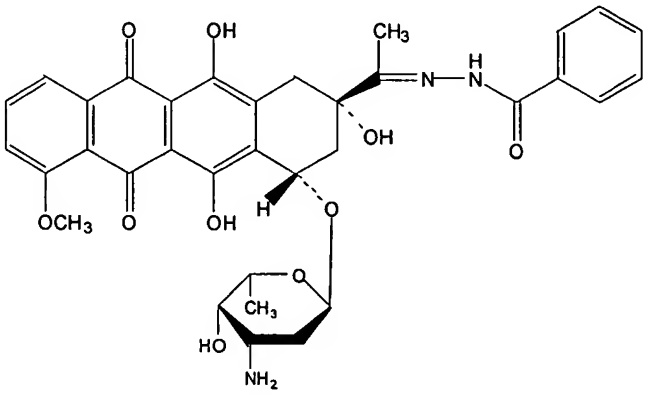
Properties: Odorless leaflets. mp 135.8-136.2°. Slightly sol in water; freely sol in alcohol, ether, chloroform, benzene.
Caution: In concd form may cause irritation of skin, mucous membranes. *See also* Salicylic Acid.
Use: Anti-mildew, fungicide.
Therapeutic Category: Antifungal (topical).
Therapeutic Category (Vet.): Antifungal (topical).

Monograph number: 08418
Title: Salsalate
CAS Registry Number: 552-94-3
CAS Name: 2-Hydroxybenzoic acid 2-carboxyphenyl ester
Additional Names: disalicylic acid ; salicylic acid bimolecular ester; salicyloxysalicylic acid; salicylsalicylic acid
Manufacturers' Codes: NSC-49171
Trademarks: Disalcid (3M) ; Disalgesic (3M); Mono-Gesic (Central); Salflex (Carnrick)
Molecular Formula: $C_{14}H_{10}O_5$
Molecular Weight: 258.23
Percent Composition: C 65.12%, H 3.90%, O 30.98%
Literature References: Nonacetylated aspirin analog. Prepn: **DE 211403** and **DE 214044** (1909, both to Boehringer, Mann.), *Frdl.* **9,** 928 and *C.A.* **4,** 368 (1910); W. Baker *et al., J. Chem. Soc.* **1951,** 201. Metabolism: S. M. Dromgoole *et al., J. Pharm. Sci.* **73,** 1657 (1984). Clinical evaluation in arthritis: T. C. McPherson, *Clin. Ther.* **6,** 388 (1984). Mechanism of action studies: C. A. Divincenzo, F. R. Venezio, *Curr. Ther. Res.* **42,** 720 (1987). HPLC determn in plasma and urine: L. I. Harrison *et al., J. Pharm. Sci.* **69,** 1268 (1980). Review of chemistry, pharmacokinetics, safety and clinical efficacy: P. T. Singleton, *Clin. Ther.* **3,** 80-102 (1980).



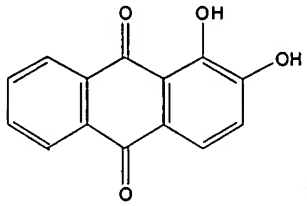
Properties: Crystals from benzene. mp 148-149°. Practically insol in water but gradually hydrolyzed by it into 2 mols of salicylic acid. Sol in alc, ether; sparingly sol in benzene.
Therapeutic Category: Analgesic, anti-inflammatory.

Monograph number: 10247
Title: Zorubicin
CAS Registry Number: 54083-22-6
CAS Name: (2*S-cis*)-Benzoic acid [1-[4-[(3-amino-2,3,6-trideoxy-α-L-*lyxo*-hexopyranosyl)oxy]-1,2,3,4,6,11-hexahydro-2,5,12-trihydroxy-7-methoxy-6,11-dioxo-2-napthacenyl]ethylidene]hydrazide
Additional Names: benzoic acid hydrazide 3-hydrazone with daunorubicin
Manufacturers' Codes: RP-22050
Molecular Formula: $C_{34}H_{35}N_3O_{10}$
Molecular Weight: 645.66
Percent Composition: C 63.25%, H 5.46%, N 6.51%, O 24.78%
Literature References: Semi-synthetic antibiotic related to daunorubicin, *q.v.* Prepn: G. Jolles, **DE 2327211** (1974 to Rhone-Poulenc), *C.A.* **82,** 171381x (1975). Biological activity: R. Maral *et al., C.R. Seances Acad. Sci. Ser. D* **275,** 301 (1972); R. Maral, *Cancer Chemother. Pharmacol.* **2,** 31 (1979). Distribution and metabolism in mice: R. Baurain *et al., ibid.* 37. Mechanism of action: G. P. Sartiano *et al., J. Antibiot.* **32,** 1038 (1979). Acute cardiovascular effects in dogs: E. H. Herman, R. S. Young, *Cancer Treat. Rep.* **63,** 1771 (1979). Clinical study in breast cancer: J. N. Ingle, *ibid.* 1701.



Derivative Type: Hydrochloride
CAS Registry Number: 36508-71-1
Manufacturers' Codes: NSC-164011
Trademarks: Rubidazone (Bellon)
Molecular Formula: $C_{34}H_{35}N_3O_{10}$.HCl
Molecular Weight: 682.12
Percent Composition: C 59.87%, H 5.32%, N 6.16%, O 23.46%, Cl 5.20%
Properties: Red-orange crystalline powder from ethanol. $[\alpha]_D^{20}$ -50° (c = 0.2 in water). uv max (methanol): 232.5, 253, 480, 495 nm (ε 40225, 35300, 10480, 10300). LD_{50} in mice (mg/kg): 13.66 s.c., 4.42 i.p., 8.50 i.v. (Maral, 1972).
Therapeutic Category: Antineoplastic.

Monograph number: 00246
Title: Alizarin
CAS Registry Number: 72-48-0
CAS Name: 1,2-Dihydroxy-9,10-anthracenedione
Additional Names: 1,2-dihydroxyanthraquinone ; C.I. Mordant Red 11; C.I. Pigment Red 83; C.I. 58000
Molecular Formula: $C_{14}H_8O_4$
Molecular Weight: 240.21
Percent Composition: C 70.00%, H 3.36%, O 26.64%
Literature References: Occurs in the root of the madder plant (*Rubia tinctorum* L., *Rubiaceae;* Krappwurzel) in combination with 2 mols glucose, called ruberythric acid. Was known and used in ancient Egypt, Persia, and India. Synthesized from 2-anthraquinonesulfonic acid sodium salt : Caro *et al., Ber.* **3,** 359 (1870); Perkin, *Ber.* **9,** 281 (1876). Historical *review:* Fieser, *J. Chem. Educ.* **7,** 2609 (1930). Laboratory prepn: Gattermann-Wieland, *Laboratory Methods of Organic Chemistry* (New York, 1937). Modern methods of manufacture: Pohl, *Ullmanns Encyklopädie der technischen Chemie* **vol. I,** p 200; Fierz-David and Blangey, *Grundlegende Operationen der Farbenchemie* (Vienna, 5th ed., 1943). *See also Colour Index* **vol. 4,** (3rd ed., 1971) p 4513.



Properties: Orthorhombic, orange needles by sublimation or from abs alc. Solvated scales from dil alc or by evaporation from ether. Sublimes at 110° (2 mm Hg). mp 290°. bp 430°. Absorption spectrum: Moir, *J. Chem. Soc.* **1927,** 1810. Soly in water at 18°: 2.1×10^{-6} mols/l; at 25°: 2.5×10^{-6} mols/l. Sol in 300 parts boiling water; moderately sol in alcohol, freely in hot methanol and in ether at 25°. Also sol in benzene, toluene, xylene, pyridine, carbon disulfide, glacial acetic acid. Sol in water solns of alkalies with blue color, but without fluorescence. Fluorescent solns indicate unchanged 2-anthraquinone sodium sulfonate.

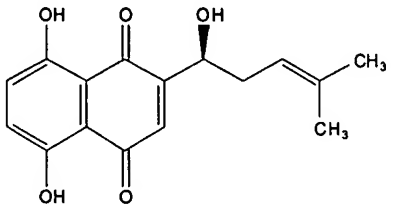
Derivative Type: 1-Methyl ether
Molecular Formula: $C_{15}H_{10}O_4$
Molecular Weight: 254.24
Percent Composition: C 70.86%, H 3.96%, O 25.17%
Properties: Orange needles with $1H_2O$ from dil methanol. When dried at 100° mp 179°.

Derivative Type: 2-Methyl ether
Molecular Formula: $C_{15}H_{10}O_4$
Molecular Weight: 254.24
Percent Composition: C 70.86%, H 3.96%, O 25.17%
Properties: Orange needles from alcohol, mp 231°.

Derivative Type: Dimethyl ether
Molecular Formula: $C_{16}H_{12}O_4$
Molecular Weight: 268.26
Percent Composition: C 71.64%, H 4.51%, O 23.86%

Properties: Golden-yellow needles from alcohol, mp 215°.
Use: In the manufacture of acid and chrome dyes for wool; acid-base indicator (in 0.5% alcoholic soln; pH: yellow 5.5, red 6.8); in spot tests as reagent for aluminum, indium, mercury, zinc, and zirconium; biological stain.

Monograph number: 00252
Title: Alkannin
CAS Registry Number: 517-88-4
CAS Name: 5,8-Dihydroxy-2-[(1*S*)-1-hydroxy-4-methyl-3-pentenyl]-1,4-naphthalenedione
Additional Names: (-)-5,8-dihydroxy-2-(1-hydroxy-4-methyl-3-pentenyl)-1,4-naphthoquinone ; anchusa acid; anchusin; alkanna red; alkanet extract; (1-hydroxy-3-isohexenyl)naphthazarine; 2-(1-hydroxy-4-methyl-3-pentenyl)-5,8-dihydroxy-1,4-naphthoquinone; C.I. Natural Red 20; C.I. 75530
Molecular Formula: $C_{16}H_{16}O_5$
Molecular Weight: 288.30
Percent Composition: C 66.66%, H 5.59%, O 27.75%
Literature References: Isoln from the root of *Alkanna tinctoria* Tausch, *Boraginaceae:* Brockmann, *Ann.* **521,** 1 (1936); Toribara, Underwood, *Anal. Chem.* **21,** 1352 (1949). Absolute configuration: Arakawa, Nakagaki, *Chem. Ind. (London)* **1961,** 947. Toxicity study: L. Majlathova, *Nahrung* **15,** 505 (1971), *C.A.* **76,** 122513j (1972).

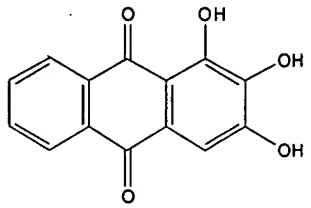


Properties: Brownish-red prisms with a metallic sheen from benzene, mp 149°. Can be sublimed in high vac at 140-150°. $[\alpha]_{Cd}^{20}$ -165° (benzene); -226° (chloroform). Also reported as -254 ± 7° (chloroform) (Toribara). Sol in organic solvents, sparingly sol in water. Buffered aq solns are red at pH 6.1; purple at pH 8.8; blue at pH 10.0. LD_{50} in male, female mice, rats (g/kg): 3.0 ± 1.0; 3.1 ± 0.1; >1.0 orally (Majlathova).

Derivative Type: (+)-Form
Additional Names: Shikonin

Derivative Type: (±)-Form
Additional Names: Shikalkin
Use: Red dye for cosmetics and food; spectrophotometric microdetermination of beryllium.
Therapeutic Category: Astringent.

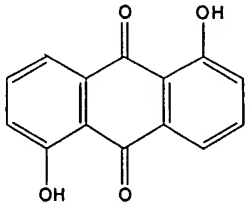
Monograph number: 00688
Title: Anthragallol
CAS Registry Number: 602-64-2
CAS Name: 1,2,3-Trihydroxy-9,10-anthracenedione
Additional Names: 1,2,3-trihydroxyanthraquinone ; anthragallic acid; anthracene brown
Molecular Formula: $C_{14}H_8O_5$
Molecular Weight: 256.21
Percent Composition: C 65.63%, H 3.15%, O 31.22%
Literature References: From gallic acid and benzoic acid with sulfuric acid at 125° or from phthalic anhydride and pyrogallol with sulfuric acid at 160°: Seuberlich, *Ber.* **10,** 39 (1877). Other methods: Kubota, Perkin, *J. Chem. Soc.* **127,** 1889 (1925); Perkin, Story, *ibid.* **1929,** 1399; Cross, Perkin, *ibid.* **1930,** 292. Absorption spectrum: Meyer, Fischer, *Ber.* **46,** 85 (1913).



Properties: Brown crystals, mp 312-313°. Sublimes 290°. Slightly sol in water, chloroform; sol in alcohol, ether, glacial acetic acid. Its soln in concd H_2SO_4 is reddish-brown. Greenish-brown soln in ammonia water changes to blue on heating. Forms salts with Na, K, Ba, Tl, Pb, La, Ce, Nd, Co.

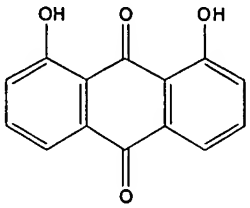
Derivative Type: Trimethyl ether
Molecular Formula: $C_{17}H_{14}O_5$
Molecular Weight: 298.29
Percent Composition: C 68.45%, H 4.73%, O 26.82%
Properties: Yellow needles from benzene + petr ether, mp 168°. Insol in water solns of alkalies.

Monograph number: 00694
Title: Anthrarufin
CAS Registry Number: 117-12-4
CAS Name: 1,5-Dihydroxy-9,10-anthracenedione
Additional Names: 1,5-dihydroxyanthraquinone
Molecular Formula: $C_{14}H_8O_4$
Molecular Weight: 240.21
Percent Composition: C 70.00%, H 3.36%, O 26.64%
Literature References: Prepd from 1,5-anthraquinone potassium disulfonate: Fierz-David, Blangey, *Farbenchemie* (Vienna, 5th ed, 1943), pp 224-225.



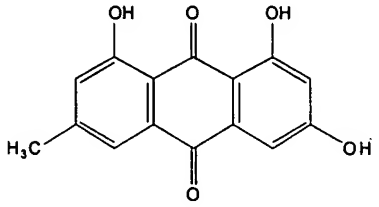
Properties: Green to yellow crystals from acetic acid, mp 280°. Sublimes at 120°. Absorption spectrum in H_2SO_4: Meyer, Fischer, *Ber.* **46,** 85 (1913). Sol in concd H_2SO_4, in aq KOH soln (reddish color); insol in aq Na_2CO_3, NH_3, $Ba(OH)_2$. Moderately sol in alcohol, slightly in water.
Use: Important intermediate in the manuf of alizarin and indanthrene dyestuffs. Forms insol Ba and Ca lakes; has been proposed as analytical reagent for the detection of Ca.

Monograph number: 02841
Title: Danthron
CAS Registry Number: 117-10-2
CAS Name: 1,8-Dihydroxy-9,10-anthracenedione
Additional Names: 1,8-dihydroxyanthraquinone ; 1,8-Dihydroxyanthraquinone; chrysazin; dantron
Trademarks: Altan ; Antrapurol; Diaquone; Istizin (Winthrop); Modane (Adria)
Molecular Formula: $C_{14}H_8O_4$
Molecular Weight: 240.21
Percent Composition: C 70.00%, H 3.36%, O 26.64%
Literature References: Prepn. Fierz-David, Blangey, *Farbenchemie* (Vienna, 5th ed., 1943) pp 224-225; Kozlov, *Dokl. Akad. Nauk SSSR* **61,** 281 (1948). Clinical trial with poloxalkol in constipation: L. Mundow, *Br. J. Clin. Pract.* **29,** 95 (1975). Mutation study: J. P. Brown, R. J. Brown, *Mutat. Res.* **40,** 203 (1976). Toxicology: M. T. Case *et al., Drug Chem. Toxicol.* **1,** 89 (1977). Review of toxicity and carcinogenic risk: *IARC Monographs* **50,** 265-275 (1990).



Properties: Orange needles from alc, mp 193-197°. Sublimes. Absorption max: 430, 250 nm (log ε 4.35, 4.60). Almost insol in water (6.5 × 10^{-6} mols/l at 25°), in alcohol (1:2000). Moderately sol in ether (1:500), in chloroform; sol in 10 parts hot glacial acetic acid. Very slightly sol in aq solns of alkali hydroxides: about 0.8 g dissolves in 100 ml 0.5*N* NaOH. (Disodium salt is reported to have a water soly of 0.05%.) LD_{50} orally in mice: <7 g/kg (Case).
Caution: This substance is reasonably anticipated to be a human carcinogen: *Report on Carcinogens, Eleventh Edition* (PB2005-104914, 2004) p III-77.
Use: Important intermediate in the manuf of alizarin and indanthrene dyestuffs; forms insol Ca, Ba, Pb lakes. Antioxidant in synthetic lubricants; fungicide.
Therapeutic Category: Cathartic.
Therapeutic Category (Vet.): Purgative.

Monograph number: 03593
Title: Emodin
CAS Registry Number: 518-82-1
CAS Name: 1,3,8-Trihydroxy-6-methyl-9,10-anthracenedione
Additional Names: 1,3,8-trihydroxy-6-methylanthraquinone ; 4,5,7-trihydroxy-2-methylanthraquinone; frangula emodin; rheum emodin; archin; frangulic acid
Molecular Formula: $C_{15}H_{10}O_5$
Molecular Weight: 270.24
Percent Composition: C 66.67%, H 3.73%, O 29.60%
Literature References: Occurs mostly as the rhamnoside (*see* Frangulin) in rhubarb root, in alder buckthorn *(Rhamnus frangula* L.*),* in *Cascara sagrada (Rhamnus purshiana* DC., *Rhamnaceae),* also in *Rumex* and in other *Polygonaceae.* Isoln from rhubarb root: Tutin, Clewer, *J. Chem. Soc.* **99,** 946 (1911); Carelli, Giuliano, *Farmaco Ed. Prat.* **12,** 184 (1957); from bark of alder buckthorn: Bridel, Charaux, *Bull. Soc. Chim. Biol.* **15,** 648 (1933). Identity with archin: Chaudhry *et al., J. Sci. Ind. Res.* **9B,** No. 6, 142 (1950), *C.A.* **44,** 9396h (1950). Synthesis from 3,5-dinitrophthalic anhydride and *m*-cresol: Elder, Widmer, *Helv. Chim. Acta* **6,** 966 (1923); from 2-methylanthraquinone: Ayyangar *et al., J. Sci. Ind. Res.* **20B,** 493 (1961), *C.A.* **57,** 8514b (1962).

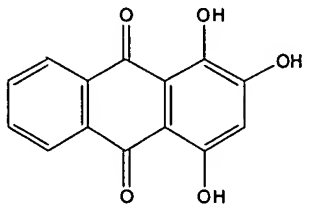


Properties: Orange needles from alc or by sublimation at 12 mm. mp 256-257°. Absorption max (ethanol): 222, 252, 265, 289, 437 nm (log ε 4.55, 4.26, 4.27, 4.34, 4.10). Practically insol in water; sol in alc, aq alkali hydroxide solns (cherry-red color), Na_2CO_3 and NH_3 solns. Soly at 25° (g/100 ml of satd soln): ether 0.140; chloroform 0.071; carbon tetrachloride 0.010; carbon bisulfide 0.009; benzene 0.041.

Derivative Type: 3-Methyl ether
Additional Names: 1,8-Dihydroxy-3-methoxy-6-methylanthraquinone ; rheochrysidin
Molecular Formula: $C_{16}H_{12}O_5$
Molecular Weight: 284.26
Percent Composition: C 67.60%, H 4.26%, O 28.14%
Properties: Brick-red, monoclinic needles, mp 207°. Occurs naturally as ***physcione*** or ***parietin***.

Derivative Type: Trimethyl ether
Molecular Formula: $C_{18}H_{16}O_5$
Molecular Weight: 312.32
Percent Composition: C 69.22%, H 5.16%, O 25.61%
Properties: Pale yellow needles, mp 225°.
Note: See also Aloe-emodin.
Therapeutic Category: Cathartic.

Monograph number: 08036
Title: Purpurin
CAS Registry Number: 81-54-9
CAS Name: 1,2,4-Trihydroxy-9,10-anthracenedione
Additional Names: 1,2,4-trihydroxyanthraquinone ; C.I. Natural Red 8; C.I. Natural Red 16; C.I. 58205; C.I. 75410
Molecular Formula: $C_{14}H_8O_5$
Molecular Weight: 256.21
Percent Composition: C 65.63%, H 3.15%, O 31.22%
Literature References: Occurs as glycoside in the madder root *(Rubia tinctorum* L., *Rubiaceae)* of commerce. Is formed during storage; no appreciable amount in the fresh root: Hill, Richter, *J. Chem. Soc.* **1936,** 1714. Although a dye itself, it is usually considered as an undesirable contamimant of alizarin extracted from madder. May be prepd from alizarin by oxidation with ammonium persulfate: Wacker, *J. Prakt. Chem.* [2] **54,** 90 (1896); also by Friedel-Crafts condensation of hydroxyhydroquinone with phthalic anhydride: Dimroth, Fick, *Ann.* **411,** 321 (1916).

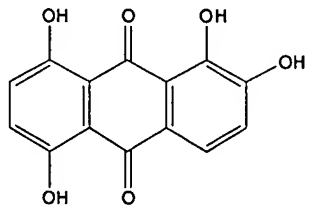


Properties: Long orange needles with 1 H_2O from dil alcohol, anhydr at 100°. Anhydr red needles from abs alcohol or by sublimation around 150° in high vacuum (less than 2 mm Hg). mp 257°. Absorption spectrum: Meek, *J. Chem. Soc.* **111,** 969 (1917); Ezaby, *ibid. (B)* **1970,** 1293. More sol in boiling water than alizarin (yellow color with yellowish hue). Freely sol in alcohol (red), in ether (intensely yellow with fluorescence). Soluble in benzene, toluene, xylene (dark yellow), in boiling alum soln (red).

Derivative Type: 2-Methyl ether
Molecular Formula: $C_{15}H_{10}O_5$
Molecular Weight: 270.24
Percent Composition: C 66.67%, H 3.73%, O 29.60%
Properties: Orange crystals from benzene, mp 240°.

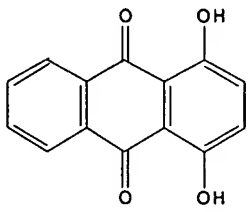
Derivative Type: 2,4-Dimethyl ether
Molecular Formula: $C_{16}H_{12}O_5$
Molecular Weight: 284.26
Percent Composition: C 67.60%, H 4.26%, O 28.14%
Properties: Orange needles, mp 186-189°.
Use: Forms colored "lakes" with various metal salts and is a fast dye for cotton printing. Now used mostly in the manuf of acid and chrome dyes. Reagent for the detection of boron; for detection of insol calcium salts in the cell contents of histological material and as a nuclear stain.

Monograph number: 08138
Title: Quinalizarin
CAS Registry Number: 81-61-8
CAS Name: 1,2,5,8-Tetrahydroxy-9,10-anthracenedione
Additional Names: 1,2,5,8-tetrahydroxyanthraquinone ; alizarin bordeaux B; C.I. Mordant Violet 26; C.I. 58500
Molecular Formula: $C_{14}H_8O_6$
Molecular Weight: 272.21
Percent Composition: C 61.77%, H 2.96%, O 35.27%
Literature References: From hemipic (hemipinic) acid and hydroquinone with H_2SO_4: Liebermann, Kostanecki, *Ann.* **240,** 245 (1887); Liebermann, Wense, *Ber.* **20,** 862 (1887). From alizarin or quinizarin by treatment with 80% oleum, then boiling with caustic: Gattermann, *J. Prakt. Chem.* [2] **43,** 246 (1891); Schmidt, *ibid.* **237,** 242 (1891); *Bull. Soc. Ind. Mulhouse* **84,** 409 (1914). *See also: Colour Index* **vol. 4** (3rd ed., 1971) p 4519.



Properties: Red needles with green metallic luster from acetic acid or from nitrobenzene or by sublimation *in vacuo.* mp >275°. Absorption spectrum: Meek, Watson, *J. Chem. Soc.* **109,** 544 (1916); Meek, *ibid.* **111,** 969 (1917). Insol in water. Very slightly sol in most other solvents. Dissolves in aq solns of alkalies with reddish-violet, in acetic acid with yellow, in sulfuric acid with blue-violet color.
Use: Dyes cotton mordanted with Al salts dark red, cotton mordanted with Cr salts bluish-violet. No longer used as a dye, except occasionally in printing cotton.

Monograph number: 08156
Title: Quinizarin
CAS Registry Number: 81-64-1
CAS Name: 1,4-Dihydroxy-9,10-anthracenedione
Additional Names: 1,4-dihydroxyanthraquinone ; C.I. 58050
Molecular Formula: $C_{14}H_8O_4$
Molecular Weight: 240.21
Percent Composition: C 70.00%, H 3.36%, O 26.64%
Literature References: Prepn from *p*-chlorophenol and phthalic anhydride: Reynolds, Bigelow, *J. Am. Chem. Soc.* **48,** 420 (1926); **US 1845632,** *C.A.* **26,** 2203; *Org. Synth.* **coll. vol. I,** 476 (New York, 1941). Prepn from hydroquinone: Gattermann-Wieland, *Praxis des Organischen Chemikers* (de Gruyter, Berlin, 40th ed., 1961) p 299. Also prepd from diazotized *p*-chloroaniline and phthalic anhydride: **GB 373999,** *C.A.* **27,** 3946 (1933); by treating anthraquinone with ammonium persulfate in sulfuric acid: Wacker, *J. Prakt. Chem.* [2] **54,** 90 (1896). Purification from contaminating purpurin: *Org. Synth.* (*loc. cit.*). *See also: Colour Index* **vol. 4** (3rd ed., 1971) p 4515.



Properties: Orange crystals from acetic acid, mp 200-203° (*Org. Syn.*). Orange plates from ether. Deep red needles from alcohol, benzene, toluene, xylene. mp 196°. Sublimes in high vacuum. Absorption spectrum: Meek, Watson, *J. Chem. Soc.* **109,** 544 (1916); Meek, *ibid.* **111,** 969 (1917). pK (18°) 9.51. Moderately sol in alcohol with red color. Sol in ether with brown color and yellow fluorescence. Sol with violet color in aq alkalies and in ammonia. Black precipitate with CO_2. One gram dissolves in about 13 g of boiling glacial acetic acid.

Derivative Type: Dimethyl ether
Molecular Formula: $C_{16}H_{12}O_4$
Molecular Weight: 268.26
Percent Composition: C 71.64%, H 4.51%, O 23.86%
Properties: mp 177°.